

European  
Cooperative  
Programme  
for Plant  
Genetic  
Resources



**ECP/GR**

**First Meeting of the ECPGR Maize Working Group  
Belgrade, Serbia, 2-3 December 2019**

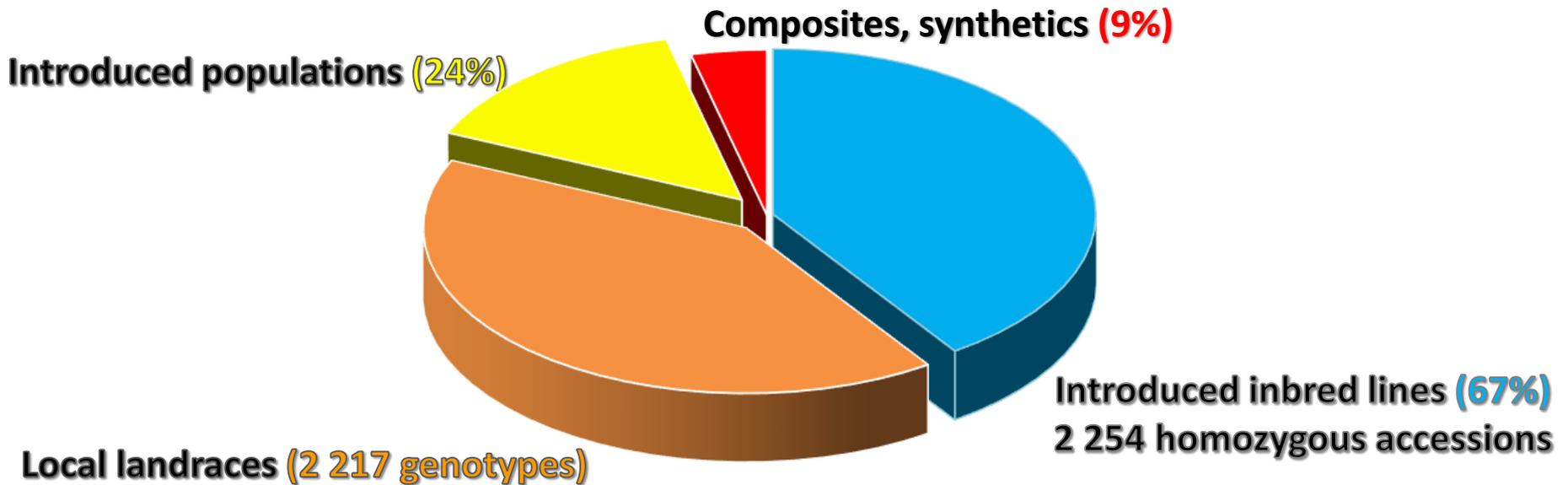
# **Maize genetic resources in Serbia current state and utilization in breeding**

## The largest maize collections

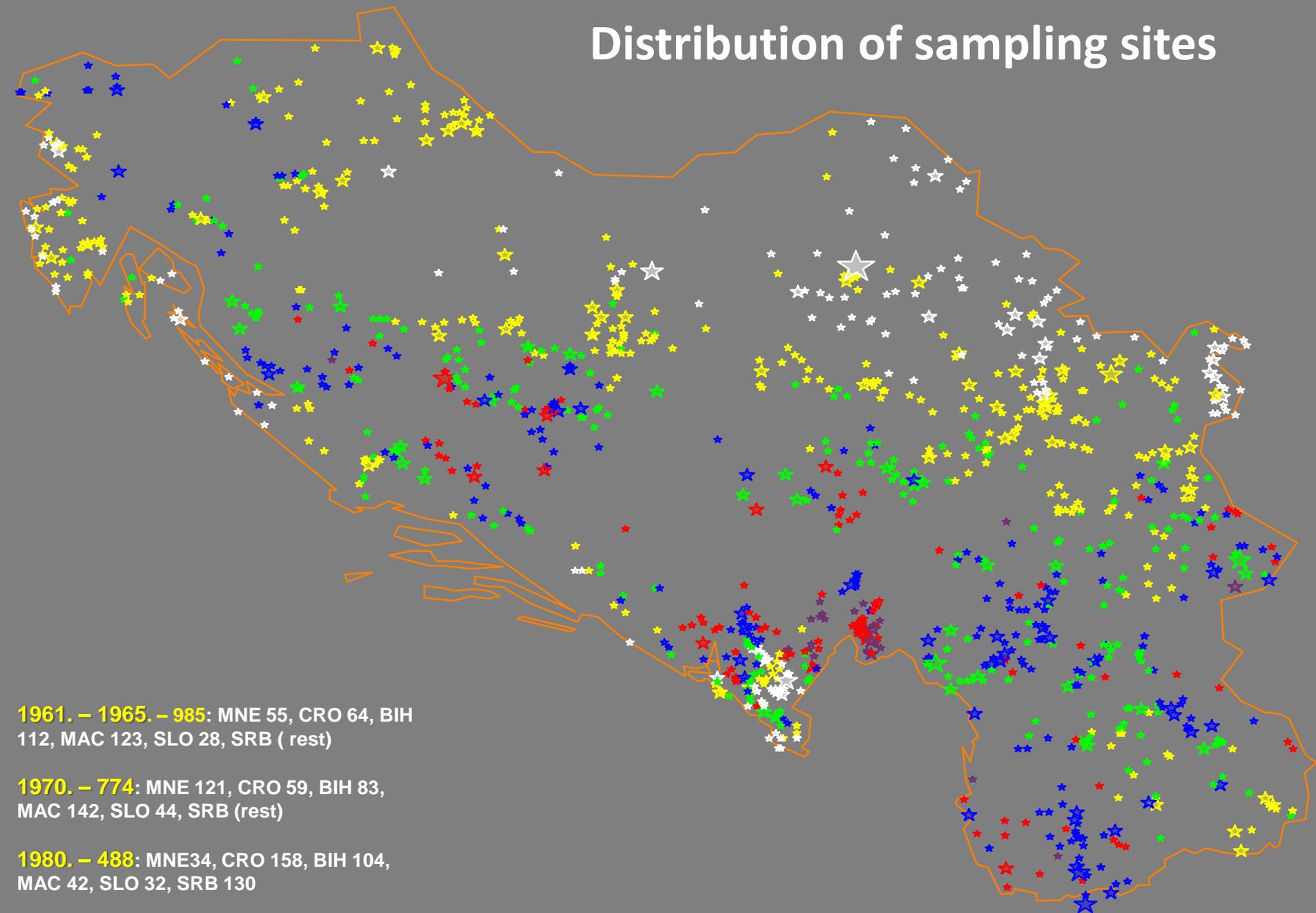
■	<b>Ukraine</b>	<b>9050</b>
■	<b>Romania</b>	<b>6813</b>
■	<b>Portugal</b>	<b>5942</b>
■	<b>Serbia</b> -MRIZP	<b>5806</b>
■	<b>Italy</b>	<b>5640</b>
■	<b>Bulgaria</b>	<b>4824</b>
■	<b>Spain</b>	<b>3035</b>
■	<b>Hungary</b>	<b>2907</b>
■	<b>Germany</b>	<b>1408</b>
■	<b>Poland</b>	<b>1102</b>

# Maize gene bank collection

**1 335 heterozygous accessions**



# Distribution of sampling sites



## Maize gene bank collection

- **Active (working) collection**
- **Medium-term storage**
- **Sample size**
- **Regeneration and multiplication**
- **Exchange and distribution** (seed shipment packets)



# Documentation level

The collection of local landraces has been fully characterized in line with the Descriptor for Maize (CIMMYT/IBPGR, 1991)

The Maize Descriptor list includes:

- passport data (accession identifiers and information recorded by collectors)
- characterization (recording of highly heritable and easily observed characteristics, expressed in all environments)
- preliminary evaluation (recording of a limited number of additional agronomic traits important to breeders)

**Selected Passport Data  
Stored in Database**

Accession Number	Genet name	Acquisition date	Number of regenerations	Photo
1	Marsenic Maize	10 December 1982	7	
2	Petrovic Vito	10 December 1982	5	
3a	Petrovic Dagan	10 December 1982	5	
3b	Petrovic Dagan	10 December 1982	5	
4	Obrovac Slav	10 December 1982	5	
6	Carlojevic Maslin	10 December 1982	7	
7	Belovic Pastor	10 December 1982	7	
16		15 January 1983	5	
1811	Krumpet Jarak	23 March 1977	5	
2217	Petrovic Stojan	11 December 1982	5	
2297	Plava Glava	25 January 1992	5	



## **Constrains to efficient conservation**

- **Large number of accessions stored in MRIZP gene bank and medium-term storage generate demand for**
- **more frequent regeneration and multiplication of accessions (money-consuming activities that require engagement of additional temporary staff)**
- **Lacking of financial support from government and Ministry of Agriculture**
- **Lacking in financial sources for modern equipment**

**MRIZP gene bank collection of local landraces is classified into 16 main and two derived agro-ecological groups, using natural classification based on morphological traits, origin and evolution**

## **Agro-ecological groups**

- 1. Montenegrin flints**
- 2. Bosnian early dents**
- 3. Kosmet flinty dents**
- 4. Macedonian flints**
- 5. Eight-rowed maize type of Ne Am.**
- 6. Derived flints**
- 7. Mediterranean flints**
- 8. Small-kernelled flints**
- 9. Eight-rowed soft dents**
- 10. Romanian flints**
- 11. Large-eared flints**
- 12. White flinty dents - Moravac**
- 13. Dents type of USA Corn belt dents**
- 14. Derived dents**
- 15. Dents type of southern areas of USA**
- 16. Serbian dents**
- 17. Flinty dents**
- 18. Dentyt flints**

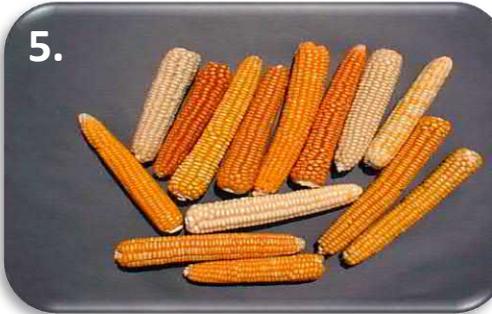


## Existing use and its valorization

- high diversity of maize eco-types represent a good potential for improvement of elite breeding material
- maize landraces are not directly used in breeding
- they are used for the development of synthetic populations or core collections for the traits of interest
- development of core collection allows the integration of the most valuable traits (adaptability, variability, divergence and heterotic potential) of underutilized gene bank germplasm

# *Eco core collection – Flints*

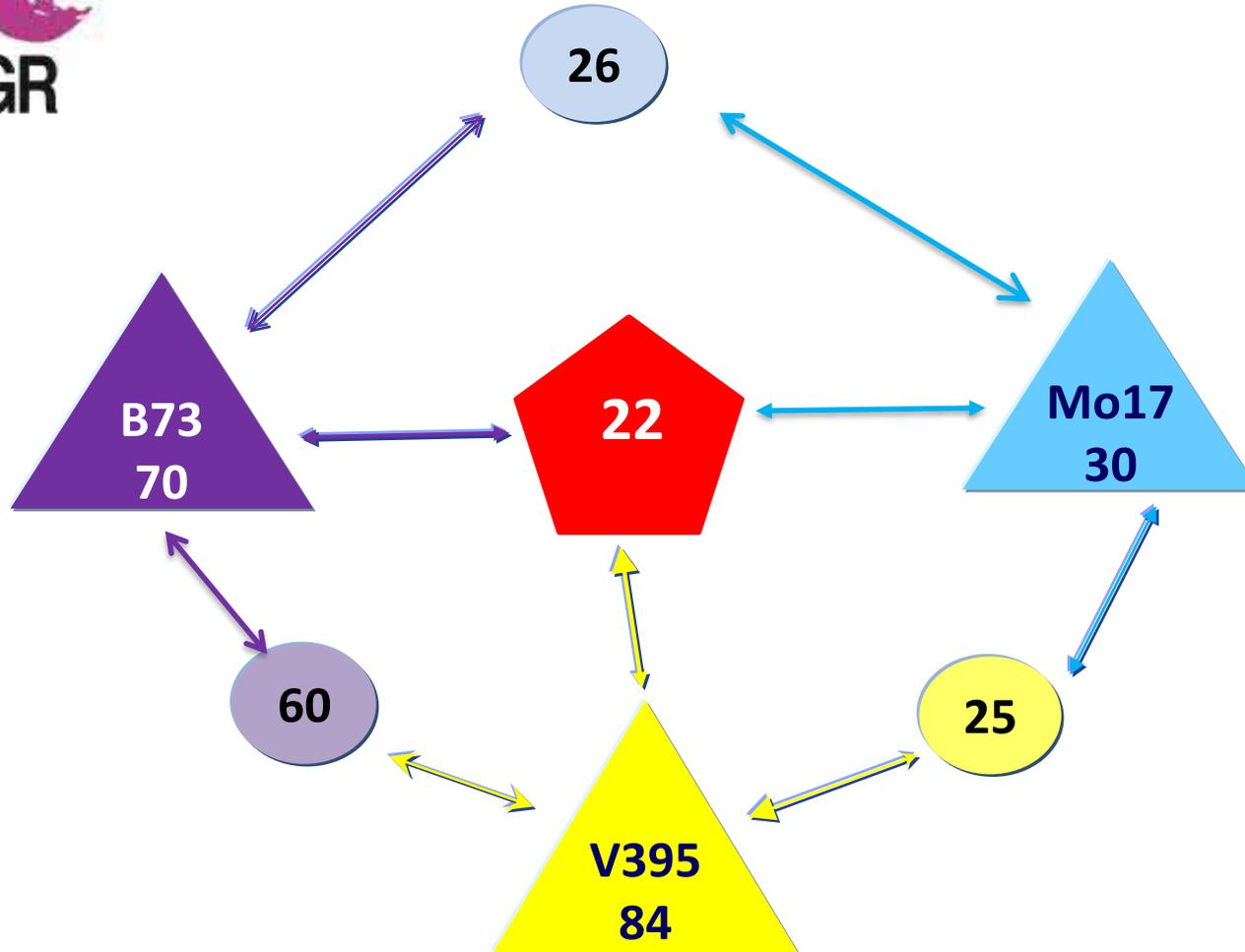
(till 2000)



## *Eco core collection - Dents*



# *Elite core collection*



**900 populations**

**FAO 500-700 were crossed to testers**

# Existing use and its valorization

## *Identification of new sources in gene bank*

( After 2000)

- Cytoplasmatic male sterility - Cms
- Herbicide tolerance
- Drought tolerance
- Grain quality



## Ongoing national projects

- **Identification of drought tolerant sources in maize gene bank (TR 20014)**, Ministry of Education, Science and Technological development, Republic of Serbia, 2008–2011
- **Exploitation of maize diversity to improve grain quality and drought tolerance (TR 31028)**, Ministry of Education, Science and Technological development, Republic of Serbia, 2011–2019



# IDENTIFICATION OF DROUGHT TOLERANT SOURCES AMONG ENTIRE MAIZE GENE BANK COLLECTION

*Controlled drought in Egypt (5806 genotypes)*

*Survived  $\approx$  769 genotypes*

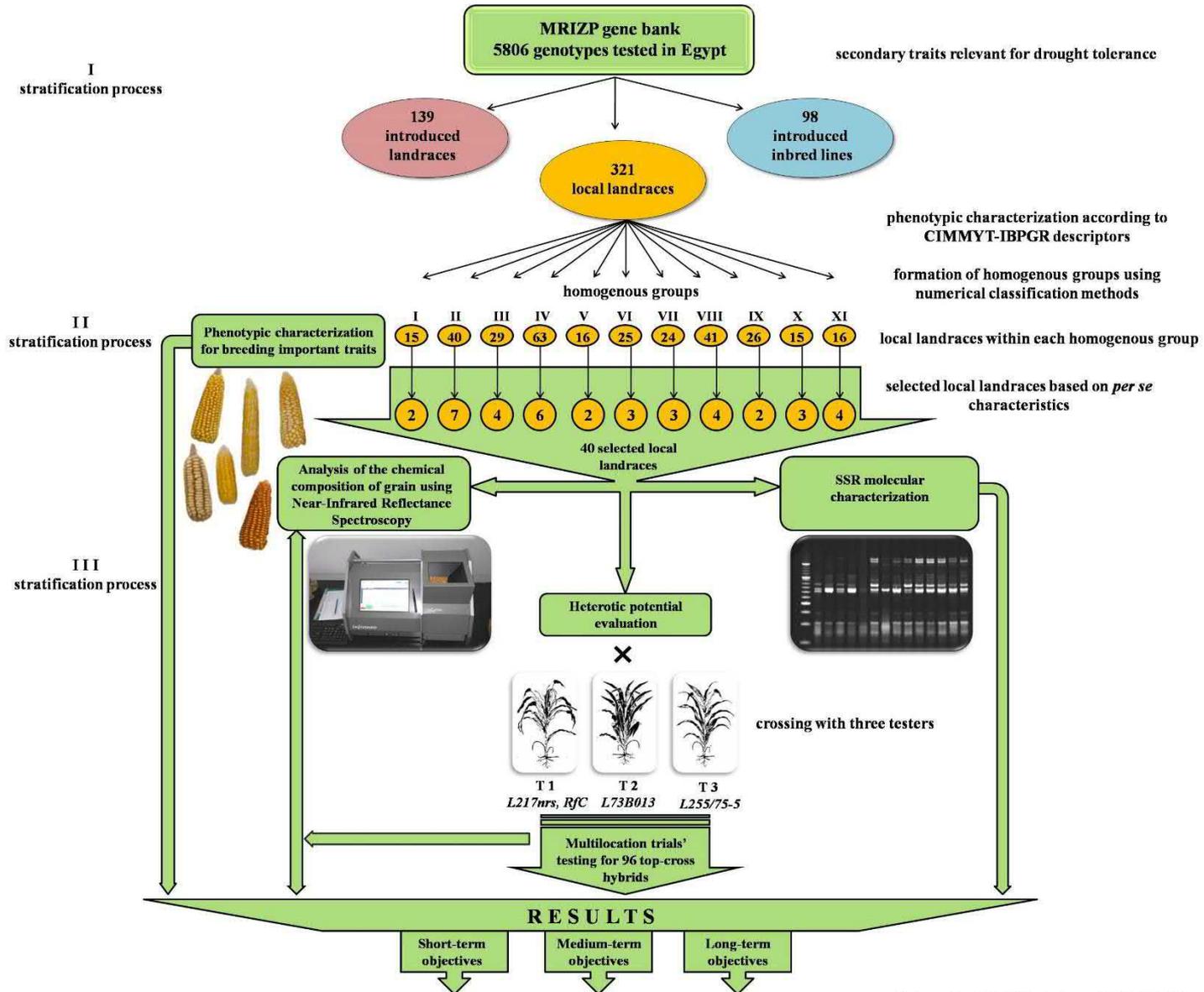
*selected  $\approx$  571 genotype*

*321 local landraces  
(long-term breeding)*

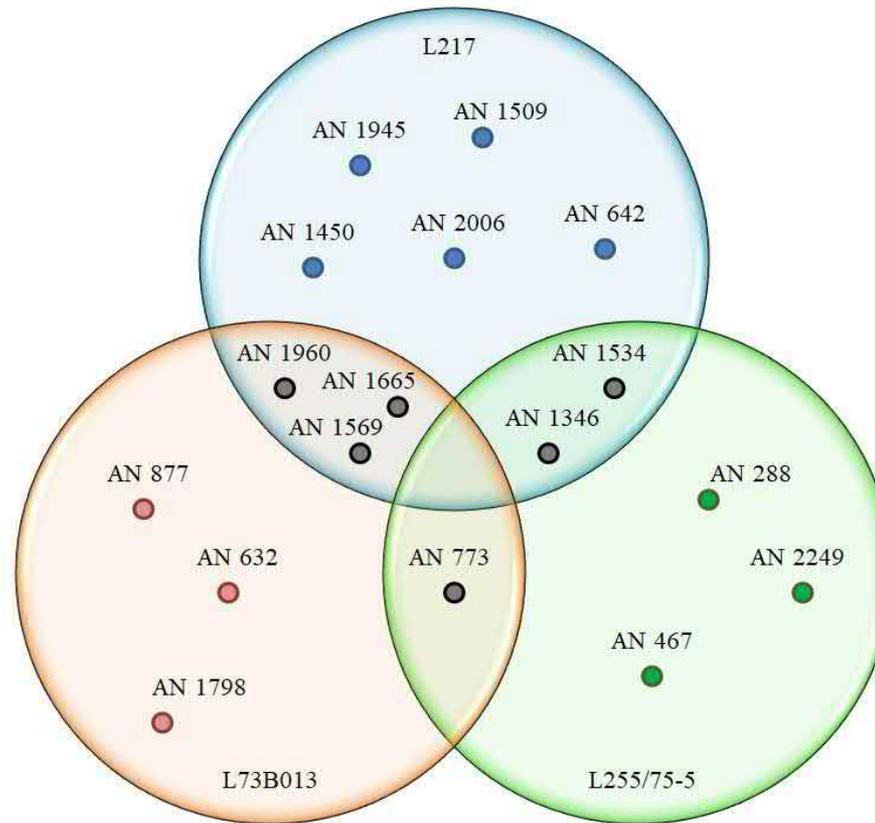
*41 accessions  
(mini-core collection)*

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# Long-term pre-breeding program for improvement of local maize populations



**Development of broad-base synthetic populations, in accordance with short, medium and long-term goals of MRIZP commercial breeding program**



Heterotic effect of the maize landraces in crosses with testers used

## Ongoing international projects

- **Biodiversity and Molecular Plant Breeding (KK.01.1.1.01.0005)**, Centre of Excellence for Biodiversity and Molecular Plant Breeding (CoE CroP-BioDiv), Republic of Croatia, 2018–2023

***OBJECTIVES AND EXPECTED RESULTS*** would be to improve maize breeding based on:

- (1) the profits increase derived from sustainable use of maize genetic resources for food and agriculture
- (2) introduction and optimization of modern high yield phenotyping techniques necessary for identification of key maize plant properties
- 3) introduction and optimization of modern genotyping based on new generation sequencing with the application of new approaches in the statistical analysis of data

## Ongoing international projects

- **Harmonization of methods for phenotyping, genotyping and management of genetic resources in maize** (337-00-205/2019-09/30), Bilateral Project with Republic of Croatia, 2019–2020

**OBJECTIVES** of the collaboration (carried out in the framework of the Project KK.01.1.1.01.0005) will include the exchange of maize inbred lines from working collection of Agricultural Institute Osijek, Republic of Croatia and MRIZP gene bank collection, genotyping and phenotyping of inbreds, as well as statistical analysis of molecular and agronomic data.

**EXPECTED RESULTS** would be to determine the set of the most relevant phenotypic traits common to all inbred lines tested, used for statistical data analysis. Joint analysis of genetic diversity originated from the Western Balkan Corn Belt, along with comparative analysis with the same standards (available genome sequencing data of public lines), will enable the determination of heterotic pattern, removal of possible duplicate and redundant accessions from the collections, contributing to a more efficient management of large inbred lines collections.

## **Expectations from maize working group**

- **Netting of gene bank managers, researchers, breeders and different kind of users (small farmers, organic farmers, food industry)**
- **Enhancing the value of underestimated and underutilised maize gene bank collections**
- **Rising public awareness about the importance for preservation and sustainable use of maize genetic resources**

**Thank you for  
your attention!**

